

Aim of the document

Overview of how to use ALMA archival data.





Help with scientific exploitation of the ALMA Science Archive.

Examples of CASA code and screenshots.

casa% uvcontsub(vis = 'my_data.ms', field = 'M100', fitspw = '0:5~50;170~240', fitorder = 1, solint='int')



Document references for more information.

Where is the Archive Primer on the ALMA Science Portal?

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About	Science	Proposing	Observing	Data	Processing	Tools	Documentation	Help	
Cycle 9	Document	S							

ALMA Science Data Tracking, Data Processing and Pipeline, Archive, QA2 and Large Program Data Products

Document	Description
SnooPl	SnooPI allows PIs, Co-Is and Delegees to track the observational and processing status of their ALMA science projects.
ALMA Guides	CASA Guides for ALMA Data.
CASA User Reference and Cookbook	
User's Guide for CASA 5.6.1	The ALMA Science Pipeline has been developed with the goal of performing automated data processing before delivery to the user. It performs ALMA interferometric and single-dish data end-to-end processing (calibration and imaging).
ALMA Science Pipeline Reference Manual (CASA v5.4)	The ALMA Science Pipeline uses specific CASA tasks, which are described in this Reference Manual.
Using ALMA Archival data - A Primer	This document provides basic introductory information of how to use the Atacama Large Millimeter/submillimeter Array (ALMA) data available through the ALMA Science Archive (ASA), including how to query, extract and scientifically exploit the content of the ASA.
ALMA Science Archive Manual	The ALMA Science Archive holds all public and proprietary ALMA science data. The Archive provides a form-based query tool to the data and allows for anonymous or authenticated download.

Where is the Archive Primer on the ALMA Science Portal?

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About	Science	Proposing	Observing	g Data	Processing	Tools	Documentation	Help	
Archiv	'e	at 🚺	Using ALMA A	rchival data - A Prin	ner	ALMA QA2 Dat	ta Products		
What's	snew			Did you know			Known issues		
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About the document



• List of Contents hyperlinked.

- Cited documents are hyperlinked.
- Will be updated on a yearly base.

This chapter provides a broad overview of the array combination process. Array combination, and particularly the combination of single dish and interferometric data, is currently the subject of ongoing development, so other references should be used to look up detailed information on the subject. The technical aspects of data combination are given in Chapter 7 of the ALMA Technical Handbook. The CASA Guide for the ALMA Science Verification observations of M100 provides an example showing how to combine and image data from the 12-m, 7-m and the ALMA Total Power Array. The CASA Documentation on combining measurement sets¹ provides details on combining *uv*-data using the CASA concat task.

Chapter 1: Introduction

- Introduction to the document.
- Introduction to ALMA.
- Introduction to the archive.



- Introduction to the ASA interface.
- Querying the archive using the ASA interface.
- Previewing the data.
- Querying the archive using Python scripts (PyVO and Astroquery).



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Chapter 3: Downloading data from the ASA

- Introduction to the Request Handler.
- Description of the data packages available.
- Previewing images with CARTA.
- Downloading options (including using Python scripts).

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Chapter 3: Downloading data from the ASA

- Introduction to the Request Handler.
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- Downloading options (including using Python scripts).



Chapter 4: Overview of downloaded archival data

- Unpacking the data.
- Archival data structure.
- Archival product files.

2016.1.01164.S science_goal.uid___A001_X885_X1ee group.uid___A001_X885_X1f5 member.uid___A001_X885_X1f6 calibration log member.uid___A001_X885_X1f6.README.txt product qa raw script

- Examples of good and bad data.
- Reviewing QA0 reports.
- Reviewing QA2 reports.
- Inspecting QA2 plots from manually calibrated data.
- Inspecting WebLogs from pipeline calibrated data.
- Using plotms to inspect data.



- Examples of good and bad data.
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	Max Baseline		360.6 m	Max Elevation		75.88 degrees		
	Number of Baselines		1128					
	Number of Antennas		48					
	Weather			PWV				

- Examples of good and bad data.
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Archived continuum image and spectral cubes are made during QA2.

- Not all Member OUS will have full imaging products.
- For some, external full imaging products exist (from ARI-L or Large Projects)

Download Selected

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- Overview of ASA images.
- Properties of ASA images.
 - Spatial/spectral coverage.
 - Sensitivity.
 - Beam size/uv-coverage.
 - Residual features and artefacts.



Calibration quality is assured, but imaging quality (spectral, angular resolution) depends on the scientific use.

- Spatial/spectral coverage.
- Sensitivity.
- Beam size/*uv*-coverage.
- Residual features and artefacts.



- Overview of ASA images.
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 - Sensitivity.
 - Beam size/*uv*-coverage.
 - Residual features and artefacts.



Chapter 7: Requesting and recreating calibrated visibilities for archival data

- Requesting calibrated visibility data.
- Recreating calibrated visibility data.

> casa --pipeline casa% execfile('member.uid___A001_X1296_Xe30.scriptForPI.py')

Checking the quality of the archived images and image cuves (Ch. 6)

Screen shots:

- Images available in ASA
- Tools for image inspection
- Properties of image products (one example)

Requesting and recreating calibrated visibilities for archival data (Ch. 7)

Screen shots:

- Requesting calibrated ms (regular + ARI-L)
- Recreating calibrated ms
- Possible issues and caveats

 \bullet

Chapter 8: Re-imaging archival data

- Continuum subtraction and spectral line imaging.
- Continuum imaging.
- Overview of important tclean parameters.

```
casa% uvcontsub(vis = 'my_data.ms',
    field = 'M100',
    fitspw = '0:5~50;170~240',
    fitorder = 1,solint='int')
```

Chapter 8: Re-imaging archival data

- Continuum subtraction and spectral line imaging.
- Continuum imaging.
- Overview of important tclean parameters.

casa% tclean(vis='my_data.ms', specmode='mfs', datacolumn='corrected', field='my_field', spw='0~3', outframe='lsrk', weighting='briggs', robust=0.5, imsize=512, cell='0.7arcsec', niter=500, interactive=True, pbcor = True)

Chapter 9: Data combination

- Preparation steps for data combination.
- Combination of 12-m Array configurations.
- Combination of 7-m and 12-m Arrays.
- Combination of TP and 7-m/12-m Arrays.

Chapter 10: Using the calibrators as science targets

- Overview of ALMA calibrator targets.
- Identifying flagged spectral features in calibrators.

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7. hif_applycal				line=HCN_V2_1	spw='22:9~22' reason='Flux_calibrator_atmospheric_line'							
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9. hif_makeimages				field=Titan								
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hif exportdata				opw-22.9~22								

Chapter 11: ALMA Calibrator Source Catalogue

- Obtaining the calibrator flux densities.
- Comparing the flux densities of archival data to the catalogues values.



Chapter 11: ALMA Calibrator Source Catalogue

- Obtaining the calibrator flux densities.
- Comparing the flux densities of archival data to the catalogues values.

casa% import analysisUtils as aU casa% aU.getALMAFlux('J1924-292', 230, date='2019-12-12', showplot=True, plotfile='J1924 230.png') Closest Band 3 measurement: 5.500 +- 0.130 (age=-2 days) 91.5 GHz (will extrapolate from this datum using spectral index) Closest Band 7 measurement: 2.780 +- 0.080 (age=+2 days) 337.5 GHz getALMAFluxCSV(Cycle6): Fitting for spectral index with 1 measurement pair of age 6.0 days from 2019-12-12, with age separation of 0 davs 2019-12-06: freqs=[103.5, 91.47, 337.47], fluxes=[5.33, 5.56, 2.75] Wrote plot: J1924 230.png Median Monte-Carlo result for 230.000000 = 3.422817 +- 0.275106 (scaled MAD = 0.273568) Result using spectral index of -0.538980 for 230.000 GHz from 5.500 Jy at 91.470 GHz = 3.346019 +- 0.275106 Jv Out[3]: 'ageDifference': 4.0, 'covar': array([[0.00034049, 0.00136793], [0.00136793, 0.00887766]]), 'fluxDensity': 3.3460192750107671, 'fluxDensityUncertainty': 0.27510639305798373, 'intercept': 0.63837706251223336, 'interceptUncertainty': 0.0, 'meanAge': -2.0, 'meanOfLogX': 2.168151400125081, 'monteCarloFluxDensity': 3.422816598521556, 'spectralIndex': -0.53898041071174752, 'spectralIndexAgeOldest': 6, 'spectralIndexAgeSeparation': 0, 'spectralIndexAgeYoungest': 6, 'spectralIndexDate': '20191211', 'spectralIndexNPairs': 1, 'spectralIndexUncertainty': 0.012793175399861925

Chapter 12: Useful additional CASA packages

Analysis Utilities.
CASA Toolkit.



Chapter 13: Frequently encountered issues



Chapter 14: Assistance with Archive mining and science exploitation

- Helpdesk.
- Knowledgebase.
- Contact your ARC or ARC node.



Example Question: How were a specific set of observations performed?

- Chapter 2: Searching the ASA
- Chapter 3: Downloading data from the ASA
- Chapter 4: Overview of the downloaded archival data
- Chapter 5: Inspecting archival data

Example Question: Can I get quick-look images of a specific object?

- Chapter 2: Searching the ASA
- Chapter 3: Downloading data from the ASA
- Chapter 4: Overview of the downloaded archival data
- Chapter 6: Checking the quality of the archived images and image cubes

Example Question: *How can I re-image archival data?*

- Chapter 2: Searching the ASA
- Chapter 3: Downloading data from the ASA
- Chapter 4: Overview of the downloaded archival data
- Chapter 7: Requesting and recreating the calibrated visibilities for archival data
- Chapter 8: Re-imaging archival data

Example Question: What problems could have affected my downloaded data?

- Chapter 5: Inspecting archival data
- Chapter 6: Checking the quality of the archived images and image cubes
- Chapter 13: Frequently encountered issues
- Chapter 14: Assistance with archive mining and science exploitation

Example Question: Why am I having problems recreating calibrated data?

- Chapter 7: Requesting and recreating the calibrated visibilities for archival data
- Chapter 13: Frequently encountered issues
- Chapter 14: Assistance with archive mining and science exploitation

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Using ALMA archival data - A Primer



The document will be updated on a yearly base.

Your feedback is very much welcome!



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ALMA, an international astronomy facility, is a partnership of Europe, North America and East Asia in cooperation with the Republic of Chile.

+ES+ 0 +	uropean outhern bservatory	ESO — Reaching New Heights in Astro	onomy								
Public	Science	User Portal Contact Site Map Search	Go!								
Science Users In	formation > Observir	Facilities > ALMA > European ALMA Regional Centre > ALMA Archive School 2022 20 May 20)22								
ALMA		ALMA Archive School 2022									
ALMA News											
About ALMA		The European Network of the ALMA Regional Centre is pleased to announce the									
ALMA Observato	ory										
Observing with A		ALMA Science Archive School									
European Develo	opment Studies	Italian ARC node headquarters,									
European ALMA	Regional Centre	Area della Ricerca Campus, Bologna									
ALMA Explaine	ed										
ALMA Archive	School 2022	5-7 October 2022									
ALMA Recount	ts of Cosmic										
Conundrums		The school will present an overview of the ALMA Science Archive, of the most advanced tools to exploit the archive content for science, and a discussion of possible tricks to addre	ess								
Meeting of ALN Astronomers	/A Young	mining issues.									
Contact Inform	ation	The event is targeted to astronomers with an interest in ALMA archival research and a basic understanding of interferometry.									
ARC Staff at E	so	For this reason lectures and tutorials will be combined with discussion and support sessions to address participants' requests, offered by members of the European ARC network.									
User Support a	it the EU ARC	In order to guarantee an efficient training environment in presence, and to cope with post-pandemic safety limitations, participation is limited to 50 people. In case there are more the	nan								
Agenda		50 registrations, priority will be given to applicants having plans for archival mining projects.									
Employment		To register to the meeting please make use of the registration form.									
	-	The registration form will remain onen until July 15th 2022									
1											
	igional Centre	The participants will be notified by the 10th of August.									
		Draft Program									

http://www.eso.org/sci/facilities/alma/arc/alma-archive-school2022.html